1. Please describe the function of simply AM signal in most general form. And point out two required conditions on amplitude sensitivity, if violate these conditions what problems will happen?

2. A DSB-SC modulated signal is demodulated by applying it to a coherent detector.
   (a) Evaluate the effect of a frequency error Δf in the local carrier frequency of the detector, measured with respect to the carrier frequency of the incoming DSB-SC signal.
   (b) For the case of a sinusoidal modulating wave, show that because of the frequency error, the demodulated signal exhibits beats at the error frequency.

3. Using the definition of the Hilbert transform, show that a SSB modulated signal resulting from the message signal m(t) and carrier $\cos(2\pi f_c t)$ of unit amplitude is given by

$$s(t) = \frac{1}{2} m(t)\cos(2\pi f_c t) \pm \frac{1}{2}\hat{m}(t)\sin(2\pi f_c t)$$

Where the minus sign corresponds to the transmission of the upper sideband and the plus sign corresponds to the transmission of the lower sideband.